Study of nonideal ultracold calcium plasma based on autoionization of Rydberg states

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We have developed a sensitive spectroscopic technique for study of a dilute ultracold plasma using a laser induced autoionization of Rydberg atoms. In our experiment the ultracold ^{40}Ca Rydberg atoms and ions are prepared in a magneto-optical trap by several cw lasers [1]. We detected the plasma with ion and electron densities below 2×10^{-3} m by using our technique. The autoionization resonance is observed as a variation of the resonance fluorescence of the ^{40}Ca ions at a wavelength of 397 nm. The probability of autoionization of atoms is very sensitive to an external electric field [2], which makes autoionization states of alkaline earth metals a promising detector of low electric fields [3].
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